# FLUID INFLATABLE PACKER AND METHOD

## BACKGROUND

**[0001]** The present invention relates generally to methods and apparatus for preparing and treating a well, and more particularly to a fluid inflatable packer and method.

**[0002]** In treating and preparing a well for production, a packer is often used to isolate zones of the wellbore. A packer is a selectively expandable downhole device that prevents or controls the flow of fluids from one area of the wellbore to another. For example, during production enhancement operations a packer may be used to direct acid, fracturing (commonly referred to as frac), or other process fluid into a desired zone while isolating the remaining zones of the wellbore from the process fluid.

**[0003]** The packer is run into the wellbore on a work string or production tubing. Seal elements are expanded radially to seal the packer against the wellbore. The seal elements may be hydraulically or mechanically expanded. After the packer has been set, it seals the annulus of the well to block movement of fluids through the annulus past the packer location. Once set, the packer typically maintains the sealing engagement against the wellbore upon removal of the hydraulic or mechanical setting force.

**[0004]** Two common types of packers are mechanical and inflatable packers. Mechanical packers include slips and a sealing element to engage the wellbore. Inflatable packers include a bladder to engage the wellbore. In an inflatable packer, inflation fluid is typically introduced into and expelled from the bladder through narrow passageways in the packer head. The inflation fluid is typically process fluid that has been filtered by a filter installed in the packer assembly to remove sand or other solids.

## SUMMARY

**[0005]** A fluid inflatable packer and method are provided for use in oil, gas, geothermal, and other wells. The fluid inflatable packer may in one embodiment be inflated with unfiltered process fluid. In another embodiment, the fluid inflatable packer may inflate and deflate with downhole process fluid pressure.

**[0006]** In accordance with a particular embodiment, a fluid inflatable packer includes a mandrel having an elongated tubular body with a number of openings along its length. An inflatable element is disposed about the elongated tubular body of the mandrel. The inflatable element is exposed to an interior of the mandrel through the openings. The inflatable element inflates and deflates with the pressure of process fluid in the interior of the mandrel.

**[0007]** In accordance with another particular embodiment, a fluid inflatable packer may include a mandrel having an elongated tubular body. An inflatable element is disposed about the elongated tubular body of the mandrel. The inflatable element is inflated by unfiltered process fluid provided through at least one opening in the elongated tubular body of the mandrel to an inflation chamber formed between the inflatable element and the elongated tubular body of the mandrel.

**[0008]** More specifically, in some embodiments, the openings in the mandrel may comprise twenty, thirty-five, or fifty or more percent of the surface area of the mandrel. In these and other embodiments, the fluid inflatable packer may be inflated with process fluid including five or more pounds of sand or other solids per gallon. In an alternate embodiment, a fluid inflatable packer may omit the mandrel. In this embodiment, an inflatable element with an elongated body may be disposed between an upper sub and a lower sub. The inflatable element is exposed to an interior of the fluid inflatable packer and inflates and deflates with process fluid pressure in the interior of the packer.

**[0009]** Technical advantages of one or more embodiments of the fluid inflatable packer and method include providing a fluid inflatable packer that is inflated with unfiltered process fluid. As a result, filters and other downhole treatment devices for process fluid that is used for inflation may be omitted. In addition, the fluid inflatable packer may be directly inflated by process fluid. Thus, delicate and/or narrow inflation passageways easily clogged by sand or other particulate matter present in process fluid may also be omitted. As a result, manufacturing and maintenance costs of the fluid inflatable packer may be reduced while reliability is increased.

**[0010]** Another technical advantage of one or more embodiments of the fluid inflatable packer and method includes providing a fluid inflatable packer that inflates and deflates with process fluid pressure. Thus, the fluid inflatable packer may be inflated and used in connection with production enhancement and other well processes without being set in the wellbore. Upon the termination of pumping and a corresponding drop in process fluid pressure, the packer automatically deflates to allow the packer to be retrieved from and/or repositioned in the well.

**[0011]** Various embodiments of the fluid inflatable packer and method may include all, some, or none of the advantages described above. Moreover, other technical advantages will be readily apparent from the following figures, descriptions, and claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0012]** FIG. 1 illustrates one embodiment of a fluid inflatable packer;

**[0013]** FIGS. 2A-2B illustrate one embodiment of deflated and inflated states of the fluid inflatable packer of FIG. 1 along lines 2-2;

**[0014]** FIGS. 3A-3E illustrate various exemplary alternate embodiments of the fluid inflatable packer of FIG. 1;

**[0015]** FIG. 4 illustrates one embodiment of a work string including a plurality of fluid inflatable packers for treating a zone of a wellbore;

**[0016]** FIG. 5 illustrates another embodiment of a work string including a fluid inflatable packer for treating a zone of a wellbore; and

**[0017]** FIG. 6 illustrates one embodiment of a method for deploying and using the fluid inflatable packer of FIG. 1 in a wellbore.

## DETAILED DESCRIPTION

[0018] FIG. 1 illustrates one embodiment of a fluid inflatable packer 20. In this embodiment, the fluid inflatable packer 20 is inflated with unfiltered process fluid and inflates and deflates with process fluid pressure. In other embodiments, the fluid inflatable packer 20 may inflate with filtered or otherwise treated process fluid and/or may not inflate and deflate with process fluid pressure.

[0019] Referring to FIG. 1, the fluid inflatable packer 20 includes an open mandrel 22, a packer element 24 disposed outwardly around or otherwise about the open mandrel 22, an upper sub 26, and a lower sub 28. A main longitudinal passageway 30 extends through the open mandrel 22 and forms the interior of the open mandrel 22. As described in more detail below in connection with FIG. 3B, the open mandrel 22 may be omitted from the fluid inflatable packer 20 without departing from the scope of the present invention.

[0020] The open mandrel 22 provides a frame for the fluid inflatable packer 20 and may be formed of one or more pieces. For example, the open mandrel 22 may be machined from a single piece of material or formed from longitudinal or crisscrossing bars, cables and/or rods. The open mandrel 22 has an elongated tubular body 32 with at least one opening 40 along its length. The elongated tubular body 32 is substantially longer than it is wide and may have a cross-section that is circular or otherwise suitably shaped. In the illustrated embodiment, the elongated tubular body 32 includes a plurality of openings 40 along its length. The openings 40 may be substantially evenly spaced around the circumference of the elongated tubular body 32 and along its length. The openings 40 may be square in shape as shown or may be other suitable shapes, such as quadrilateral shaped, round shaped, oval shaped, etc. The openings 40 may form, take up, or otherwise comprise a majority of the surface area of the open mandrel 22. In a particular embodiment, the openings 40 may comprise twenty, thirty-five, fifty, sixty, seventy,

eighty, or more percent of the surface area of the open mandrel 22 that is covered by the packer element 24 or an inflatable portion of the packer element 24. Thus, a substantial or a majority portion of the interior of the packer element 24 is directly exposed to process fluid and pressure in the main longitudinal passageway 30 of the open mandrel 22.

**[0021]** The packer element 24 includes an inflatable element 42 disposed between and coupled to tensioning collars 44. The tensioning collars 44 maintain the inflatable element 42 in tension such that the inflatable element 42 is biased to deflate, or contract, with a reduction in pressure in the main longitudinal passageway 30 of the open mandrel 22. The tensioning collars 44 may be any collar or other suitable device fixably or otherwise secured or coupled to the open mandrel 22 such that the inflatable element 42 can be maintained in tension. The tensioning collars 44 may be fixably secured to the open mandrel 22 by being directly affixed to the open mandrel 22 or to another item or items directly or indirectly coupled to the open mandrel 22. Thus, in some embodiments, the tensioning collars 44 may be indirectly coupled to or about the open mandrel 22 and may move laterally or otherwise about the open mandrel 22. In a particular embodiment, as described in more detail below in connection with FIG. 3C, one or both of the tensioning collars 44 may be acted on by a spring laterally biasing the one or both tensioning collars 44 away from each other.

**[0022]** The inflatable element 42 may overlay all or only a portion of the open mandrel 22. In the illustrated embodiment, the inflatable element 42 overlays a majority of the open mandrel 22 and a majority of the openings 40 in the open mandrel 22. The inflatable element 42 may include a bladder 50 directly overlaying the open mandrel 22, a reinforcing element 52 disposed outwardly of the bladder 50, and a cover 54 disposed outwardly of the reinforcing element 52. The bladder 50 forms an inner tube which is a pressure-holding member and may be fabricated of elastomer or other suitable material. The bladder 50 is directly exposed to the

openings 40 in the open mandrel 22, and thus to the main longitudinal passageway 30 through the open mandrel 22. The bladder 50 forms a seal between the interior and exterior of the fluid inflatable packer 20.

**[0023]** The reinforcing element 52 may comprise a weave or slat element reinforcing the bladder 50. In the illustrated embodiment, the reinforcing element 52 comprises a plurality of elongated, sheet-like steel slats 60, which may be rods, wire, bars and the like. The sheet-like steel slats 60 extend lengthwise along the bladder 50 and are arranged in an overlapping series of layers progressing circumferentially around the bladder 50 to form a full annular layer between the bladder 50 and the cover 54. The sheet-like steel slats 60 are secured by the tensioning collars 44 and held in tension by the tensioning collars 44. In another embodiment, the reinforcing element 52 may comprise a plurality of elongated, sheet-like steel slats in a weave element construction. In this embodiment, the weave may have a high incidence angle to facilitate deflation of the fluid inflatable packer 20 with the reduction of process fluid pressure in the main longitudinal passageway 30 of the open mandrel 22. The reinforcing element 52 may be otherwise suitably formed or omitted. In a particular embodiment, the reinforcing element 52 may include additional reinforcements at each edge of the reinforcing element 52 or proximate the tensioning collars 44 to prevent or limit severe folds or limit expansion of the inflatable element 42 and/or prevent or limit permanent sets of the fluid inflatable packer 20 in a wellbore. When using solid steel slats, a spring element may be used to improve elongation capability, while weave elements may typically be elastic enough to accept the deformation/elongation.

**[0024]** The cover 54 may be an elongated continuous sleeve-like member formed of elastomer or other suitable material. For example, the cover 54 may be oil resistant rubber such as nitrile. In operation, the cover 54 seals against the wellbore to prevent, limit, or otherwise control the flow of fluids in the annulus of the wellbore.

[0025] In a particular embodiment of the fluid inflatable packer 20, the packer element 24 may have a length of approximately 10 feet and be configured to provide a one inch spacing between the fluid inflatable packer 20 and a wellbore in the deflated or relaxed state. In this embodiment, the inflatable element 42 may be held at a tension of about two hundred fifty pounds by tensioning collars 44. Approximately sixty-five percent of the inside of the inflatable element 42 may be directly exposed to fluid and pressure in the main longitudinal passageway 30 of the open mandrel 22 through the underlying openings 40.

[0026] The upper sub 26 may be threaded for coupling the fluid inflatable packer 20 to a tubing string. The lower sub 28 may be threaded for coupling a process tool or other downhole equipment to the lower end of the fluid inflatable packer 20. Where the fluid inflatable packer 20 terminates rather than passes-through the flow of process fluid, the lower sub 28 may have a bleed-off device disposed therein. The bleed-off device terminates the flow of process fluid except for a small volume at a reduced pressure that is bleed-off to facilitate deflation of the fluid inflatable packer 20. As described in more detail below in connection with FIGS. 4-5, the bleed-off device may be a bleed-off valve, orifice or other suitable device.

[0027] FIGS. 2A-2B illustrate cross-sections of the fluid inflatable packer 20 in the deflated and inflated states in one embodiment. In particular, FIG. 2A illustrates the fluid inflatable packer 20 in the deflated, or relaxed, state. FIG. 2B illustrates the fluid inflatable packer 20 in the inflated, or expanded, state.

[0028] Referring to FIG. 2A, in the deflated state, the inflatable element 42 is held in tension against the open mandrel 22 with a substantial portion or majority of the inside of the inflatable element 42 directly exposed to the main longitudinal passageway 30 of the open mandrel 22 through openings 40. As described below, the openings 40 allow process fluid to

directly press against and inflate the inflatable element 42 to seal the fluid inflatable packer 20 against a wellbore.

[0029] Referring to FIG. 2B, in the inflated state, the inflatable element 42 is inflated to seal against a wellbore by the presence of process fluid 70 in an inflation chamber 72 formed between the inflatable element 42 and the open mandrel 22 by expansion of the inflatable element 42.

[0030] In operation, the inflated or deflated state of the fluid inflatable packer 20 will depend on the relative pressure between the main longitudinal passageway 30, which is formed by the interior of the open mandrel 22, and the exterior of the fluid inflatable packer 20, which is the pressure in the annulus of the wellbore in which the fluid inflatable packer 20 is deployed. As pressure of the process fluid 70 increases in the fluid inflatable packer 20, a greater volume of process fluid 70 enters the inflation chamber 72 to expand the inflatable element 42. As pressure decreases, the tension in which the inflatable element 42 is maintained forces process fluid 70 out of the inflation chamber 72 into the main longitudinal passageway 30 of the open mandrel 22 thus deflating, or contracting, the fluid inflatable packer 20 and allowing it to be removed and/or repositioned in the wellbore.

[0031] FIGS. 3A-3E illustrate alternate exemplary embodiments of the fluid inflatable packer 20. In particular, FIG. 3A illustrates a fluid inflatable packer 80 having a screen 82 that may be used to prevent or limit sand or other particles from entering into the inflation chamber 72 when the bleed-off device (shown in FIGS. 4-5) such as a bleed-off valve or orifice cannot be used. FIG. 3B illustrates a fluid inflatable packer 90 constructed without an open or other mandrel 22 or other support between upper sub 26 and lower sub 28. FIG. 3C illustrates fluid inflatable packer 100 constructed with connecting elements 104 between the upper sub 26 and lower sub 28 as well as with a tensioning spring 102 laterally biasing one of the tensioning

collars 44 to, for example, facilitate deflation of the fluid inflatable packer 100. FIGS. 3D-E illustrate a fluid inflatable packer 110 including an open spring mandrel 112.

[0032] Referring to FIG. 3A, the fluid inflatable packer 80 may be substantially similar to and take the form of the fluid inflatable packer 20 of FIG. 1. More particularly, the fluid inflatable packer 80 may include the open mandrel 22, the packer element 24 disposed about the open mandrel 22, the upper sub 26, and the lower sub 28. The main longitudinal passageway 30 extends through the open mandrel 22. The open mandrel 22 has the elongated tubular body 32 (shown in FIG. 1) with one or more openings 40 (shown in FIG. 1) along its length. The packer element 24 may include the inflatable element 42 disposed between and coupled to tensioning collars 44. The inflatable element 42 may include the bladder 50, the reinforcing element 52 and the cover 54. The reinforcing element 52 may comprise a plurality of elongated, sheet-like steel slats 60. The inflation chamber 72 (shown in FIG. 2B) may be formed between the inflatable element 42 and the open mandrel 22 by expansion of the inflatable element 42.

[0033] The screen 82 may in one embodiment be used when a bleed-off device such as a bleed-off valve or orifice cannot be used and the fluid inflatable packer 80 is used as a lower packer to prevent or limit sand or other particles from entering into the inflation chamber 72. The screen 82 may have an elongated tubular body 84 and be configured to set within the interior of the open mandrel 22 and cover the openings 40. In one embodiment, the screen 82 may be a wire screen with a 200-400 mesh. The screen 82 may be otherwise configured, may be routinely used with the fluid inflatable packer 80, or may in many or all embodiments be omitted.

[0034] Referring to FIG. 3B, the fluid inflatable packer 90 may be similar to the fluid inflatable packer 20 of FIG. 1 except that the fluid inflatable packer 90 is constructed without the open mandrel 22. Thus, for example, the fluid inflatable packer 90 may include the packer element 24 disposed between the upper sub 26 and the lower sub 28 and the main longitudinal

passageway 30 extending through the interior of the fluid inflatable packer 90. The packer element 24 includes the inflatable element 42 disposed between and coupled to tensioning collars 44. The inflatable element 42 may include the bladder 50, the reinforcing element 52 and the cover 54. The reinforcing element 52 may include a plurality of the elongated, sheet-like steel slats 60. The fluid inflatable packer 90 may, in one embodiment, be used in lower pressure applications.

**[0035]** In the fluid inflatable packer 90, the bladder 50 is completely or at least substantially completely and directly exposed to the main longitudinal passageway 30, and thus to process fluid and pressure in the main longitudinal passageway 30. In this embodiment, the sheet-like steel slats 60 may be strengthened and/or the reinforcing element 52 may comprise a weave to strengthen the inflatable element 42 and provide support and/or rigidity for the fluid inflatable packer 90 between the upper sub 26 and the lower sub 28.

**[0036]** Referring to FIG. 3C, the fluid inflatable packer 100 may be substantially similar to fluid inflatable packer 90 of FIG. 3B except that the tensioning spring 102 is provided to laterally bias one of the tensioning collars 44 to facilitate deflation of the fluid inflatable packer 100 and one or more connecting elements 104 are provided between the upper sub 26 and the lower sub 28. Thus, the fluid inflatable packer 100 may include the packer element 24 with the inflatable element 42 disposed between and coupled to tensioning collars 44. The inflatable element 42 may include the bladder 50, the reinforcing element 52 and the cover 54. The reinforcing element 52 may include the sheet-like steel slats 60 and may, as described in connection with FIG. 3B, be strengthened to provide additional rigidity and/or support for the fluid inflatable packer 100 between the upper sub 26 and lower sub 28.

**[0037]** The tensioning spring 102 laterally biases the upper tensioning collar 44 toward the upper sub 26 to facilitate deflation of the fluid inflatable packer 100. An upper end 106 of the

tensioning spring 102 may be attached or otherwise coupled to the upper sub 26. A lower end 108 of the tensioning spring 102 may be coupled or otherwise attached to the upper tensioning collar 44 or, in another embodiment, directly to the inflatable element 42. The tensioning spring 102 may be machined out of an end of the upper sub 26 or separately formed. The tensioning spring 102 may be configured to have a tensioning force that is overcome by a low process fluid pressure such as 100 psi or greater in the main longitudinal passageway 30 of the fluid inflatable packer 100. As previously described, the tensioning spring 102 may, in many embodiments, be omitted. In addition, a second tensioning spring may be used to laterally bias the lower tensioning collar 44 toward the lower sub 28.

**[0038]** The connecting elements 104 are attached or otherwise coupled between the upper sub 26 and lower sub 28 or other suitable elements of the fluid inflatable packer 100. The connecting elements 104 may comprise bars, tubes, cables, wires or other suitable elements to provide support for the fluid inflatable packer 100 when in tension and/or compression. In particular embodiments, the connecting elements 104 may comprise cables when only tension support is provided between the upper sub 26 and lower sub 28 and may comprise bars when both tension and compression support is provided for the fluid inflatable packer 100 between the upper sub 26 and lower sub 28.

**[0039]** In the illustrated embodiment, the connecting elements 104 are circumferentially attached between the upper sub 26 and lower sub 28. In other embodiments, a single connecting element 104 or set of connecting elements 104 may extend centrally or otherwise within the main longitudinal passageway 30 between the upper sub 26 and lower sub 28. In this embodiment, the connecting elements 104 may connect to a T-bar, plate, vein or other support attached to each of the upper sub 26 and lower sub 28 and extending across the main longitudinal passageway 30.

**[0040]** Referring to FIGS. 3D-E, the fluid inflatable packer 110 may be substantially similar to the fluid inflatable packer 20 of FIG. 1 except that the open spring mandrel 112 is provided in place of the open mandrel 22. Thus, the fluid inflatable packer 110 may include packer element 24 disposed about the open spring mandrel 112, the upper sub 26, and lower sub 28. The main longitudinal passageway 30 extends through the open spring mandrel 112. The packer element 24 includes the inflatable element 42 disposed between and coupled to tensioning collars 44. The inflatable element 42 may include the bladder 50, the reinforcing element 52 and the cover 54. The reinforcing element 52 may include a plurality of the elongated, sheet-like steel slats 60.

**[0041]** The open spring mandrel 112 may provide a frame for the fluid inflatable packer 110 and may be formed of one or more pieces. For example, the open spring mandrel 112 may be machined from a single piece of material or, for example, be formed from a conventional spring attached to a mandrel body. The open spring mandrel 112 has an elongated tubular body 114 with at least one opening 116 along its length. The elongated tubular body 114 is substantially longer than it is wide and may have a cross-section that is circular or otherwise suitably shaped.

**[0042]** In the illustrated embodiment, the openings 116 includes a plurality of circular openings 118 at a first end of the elongated tubular body 114 and an elongated cork-screw opening 120 extending from the first end along a majority of the elongated tubular body 114. The openings 116 may be any suitable shape and/or size. The openings 116 may form, take up or otherwise comprise a significant portion of the surface area of the open spring mandrel 112. In a particular embodiment, the openings 116 may comprise twenty or thirty-five percent of the surface area of the open spring mandrel 112 that is covered by the packer element 24 or an inflatable portion of the packer element 24. Thus, a substantial or other portion of the interior of

the packer element 24 is directly exposed to process fluid and pressure in the main longitudinal passageway 30 of the open spring mandrel 112.

**[0043]** An upper end 122 of the open spring mandrel 112 may be attached or otherwise coupled to the upper sub 26. The open-spring mandrel 112 laterally biases the upper tensioning collar 44 toward the upper sub 26 to facilitate deflation of the fluid inflatable packer 110. The open spring mandrel 112 may be configured such that the tensioning force generated by the open spring mandrel 112 is overcome by a threshold, predefined, estimated or other suitable pressure in the main longitudinal passageway 30 of the open spring mandrel 112.

**[0044]** FIGS. 4-5 illustrate use of the fluid inflatable packer 20 in a wellbore in connection with a downhole process. The process may be a well completion process, a production enhancement process, or other suitable process for treating a wellbore. In the illustrated embodiments, the fluid inflatable packer 20 is used in connection with frac processes.

**[0045]** Referring to FIG. 4, a wellbore 130 extends from the surface to a subterranean formation 132. The wellbore 130 may be a vertical, straight, slopping, deviated, or other suitable wellbore 130. In the illustrated embodiment, the wellbore 130 is a deviated wellbore 130 including a substantially vertical portion 134, an articulated portion 136, and a substantially horizontal portion 138. The subterranean formation 132 may be a hydrocarbon producing or other suitable formation.

**[0046]** A work string 140 is disposed in the wellbore 130 and extends from the surface to the subterranean formation 132. The work string 140 includes a tubing string 142 and a downhole tool assembly 144. The tubing string 142 may be a casing string, section pipe, coiled tubing, or suitable tubing operable to position and provide process fluid 70 to the downhole tool assembly 144.

[0047] The downhole tool assembly 144 includes fluid inflatable packers 20 and a process tool 146. As previously described, the fluid inflatable packers 20 each include an open mandrel 22 and a surrounding inflatable element 42 forming an inflation chamber 72 therebetween. Process fluids 70 freely and directly flow into, or enter, the inflation chamber 72 to inflate the fluid inflatable packer 20 and exit the inflation chamber 72 to deflate the fluid inflatable packer 20. In particular, the inflation chamber 72 inflates as process fluid 70 pressure in the open mandrel 22 increases relative to pressure in annulus 148 of wellbore 130 and deflates as process fluid 70 pressure in the open mandrel 22 decreases relative to pressure in the annulus 148. The inflation chamber 72 may inflate and deflate incrementally with changes in process fluid 70 pressure, may inflate to a limit or only begin or continue to inflate after a certain process fluid 70 pressure is reached, and/or may deflate to a limit or only begin or continue to deflate after a certain process fluid 70 pressure is reached. Thus, the inflation chamber 72 may inflate and deflate incrementally with each change in process fluid 70 pressure, in stages with process fluid 70 pressure changes above or below certain values, or only over a portion of the range of process fluid 70 pressure changes. The fluid inflatable packer 20 may be inflated with unfiltered process fluid 70 including frac or other fluid with five, ten, or more pounds of sand or particles per gallon without the inflation chamber 72 becoming filled and/or clogged with sand or particles such that it fails to deflate.

[0048] The process tool 146 is a frac, acid, or other tool operable to perform completion, production enhancement, or other processes for the wellbore 130 and/or subterranean formation 132. The process tool 146 may be supported and centered by the fluid inflatable packers 20 and may be positioned by movement of the tubing string 142. Process fluid 70 pumped down the wellbore 130 from surface pumps and equipment may be isolated to a zone of the wellbore 130

by the fluid inflatable packers 20 which seal the annulus 148 on one or both sides of the process tool 146.

**[0049]** In the illustrated embodiment, the process tool 146 is a ported sub such as a jetting tool 152. In this embodiment, the downhole tool assembly 144 includes an upper, or first, fluid inflatable packer 150, the jetting tool 152 coupled to a lower end of the upper fluid inflatable packer 150, and a lower, or second, fluid inflatable packer 154 coupled to a lower end of the jetting tool 152. The ports or jets of the jetting tool 152 are sized such that a sufficient pressure drop is generated between the inside of the tubing string 142 and the annulus 148.

**[0050]** In operation, the upper fluid inflatable packer 150, jetting tool 152, and lower fluid inflatable packer 154 are lowered into and positioned in the wellbore 130 with the tubing string 142. The jetting tool 152 is positioned such that it is exposed to the zone of the wellbore 130 to be treated. The upper and lower fluid inflatable packers 150 and 154 are spaced apart from each other and positioned in the wellbore 130 to isolate the remaining portions of the wellbore 130 from the jetting tool 152.

**[0051]** In the absence of process fluid 70 and/or process fluid 70 at high pressures, the upper and lower fluid inflatable packers 150 and 154 are in the deflated state. In response to pumping of process fluid 70 at high pressures down the tubing string 142 to the jetting tool 152, process fluid 70 enters the upper and lower fluid inflatable packers 150 and 154, passes through the open mandrel 22 in each fluid inflatable packer 150 and 154, and into the inflation chambers 72 to inflate the inflatable elements 42. As process fluid 70 pressure increases, the upper and lower fluid inflatable packers 150 and 154 continue to expand, at least to a point, to seal the annulus 148 of the wellbore 130 and isolate the treatment zone of the wellbore 130. The upper and lower fluid inflatable packers 150 and 154 are sealed against the wellbore 130, which may be openhole, cased, or otherwise, when the flow of process fluid 70 from one side of the fluid

inflatable packers 150 or 154 to the other side in the annulus 148 of the wellbore 130 is prevented, substantially prevented, reduced, substantially reduced, limited, or otherwise controlled. The upper and lower fluid inflatable packers 150 and 154 may be configured to seal and release at any suitable process fluid 70 pressure or process fluid 70 pressure range. For example, the upper and lower fluid inflatable packers 150 and 154 may seal at process fluid 70 pressure above 2000 pounds per square inch (psi) and release at lower pressure. Upon termination of process fluid 70 pumping, the upper and lower fluid inflatable packers 150 and 154 deflate to the deflated state such that the tubing string 142 and downhole assembly 144 may be retrieved to the surface or repositioned in the wellbore 130.

**[0052]** In the illustrated embodiment, the lower fluid inflatable packer 154 includes a flow through or bleed-off device 156 such as a bleed-off valve or orifice which allows a limited amount of process fluid 70 to flow out of the lower fluid inflatable packer 154. The bleed-off device 156 thus provides flow through to maintain fluid sand concentration by continuously replenishing the fluid and preventing sand from settling and filling the inflation chamber 72. The amount of outflow through bleed-off device 156 may be controlled to regulate deflation of the lower fluid inflatable packer 154 upon completion of a process and termination of process fluid 70 pumping. The bleed-off device 156 may be a valve, a spiraling tube, orifice channel, or other device operable to bleed-off process fluid 70 at a reduced pressure from that in the interior of the lower fluid inflatable packer 154.

**[0053]** FIG. 5 illustrates a wellbore 180 extending from the surface to a subterranean formation 182. Wellbore 180 and subterranean formation 182 may be as previously described in connection with wellbore 130 and subterranean formation 132. A work string 184 including a tubing string 186 and a downhole tool assembly 188 may be disposed in the wellbore 180. The tubing string 186 may be as described in connection with tubing string 142.

[0054] The downhole tool assembly 188 includes a jetting tool 190 and lower fluid inflatable packer 192. The jetting tool 190 may be a hydrajetting tool of the type used in SURGIFRAC fracturing services, or often known as Hydrajet Fracturing services. In this embodiment, the jetting tool 190 includes a plurality of fluid jet forming nozzles which are disposed in a single plane aligned with the plane of maximum principal stress in the subterranean formation 182 to be fractured. Such alignment may result in the formation of a single fracture extending outwardly from and around the wellbore 180. The lower fluid inflatable packer 192 may be as described in connection with lower fluid inflatable packer 154 of FIG. 4. Thus, the lower fluid inflatable packer 192 may include an open mandrel 22, surrounding inflatable element 42, and an inflation chamber 72 formed therebetween. A bleed-off device 194 may be provided at a lower end of the lower fluid inflatable packer 192. As described in connection with bleed-off device 156, bleed-off device 194 allows flow through to maintain fluid sand concentration.

[0055] In operation, process fluid 70 is pumped from the surface to the downhole tool assembly 188. At the downhole tool assembly 188, the process fluid 70 exits nozzles of the jetting tool 190 to fracture the subterranean formation 182 and enters the lower fluid inflatable packer 192 which inflates to seal a lower portion of the wellbore 180 from the process fluid 70 and process fluid 70 pressures of the SURGIFRAC fracturing service operation. Upon termination of the operation and process fluid 70 pumping, the lower fluid inflatable packer 192 deflates to a deflated state such that the tubing string 186 and downhole tool assembly 188 may be retrieved to the surface or repositioned in the wellbore 180. In the deflated state, the lower fluid inflatable packer 192 may return to its original deflated, or relaxed, position or to an intermediate position in which it is not sealing and/or engaged with the wellbore 180.

[0056] FIG. 6 is one embodiment of a method for deploying and using the fluid inflatable packer 20. The method will be described in connection with the frac operation of FIG. 4. The method may be used for any other suitable well treatment or other process.

[0057] Referring to FIG. 6, the method begins at step 200 in which the upper and lower fluid inflatable packers 150 and 154 are along with the jetting tool 152 positioned in the wellbore 130. At step 202, process fluid 70 is pumped from the surface down the tubing string 142 to the upper and lower fluid inflatable packers 150 and 154 and jetting tool 152. At step 204, the upper and lower fluid inflatable packers 150 and 154 are inflated by flowing process fluid 70 at pressure into the inflation chamber 72. In one embodiment, the process fluids 70 may be pumped at pressures of between 3,000 and 7,000 psi.

[0058] Next, at step 206, process fluid 70 pressure is maintained to perform the frac process through jetting tool 152. At step 208, inflation of the upper and lower fluid inflatable packers 150 and 154 is maintained based on the maintained process fluid 70 pressure.

[0059] At step 210, after a completion of the frac process, pumping of the process fluid 70 is terminated. At step 212, as the pressure of process fluid 70 declines downhole upon termination of pumping, the upper and lower fluid inflatable packers 150 and 154 are each deflated automatically by the tension of the inflatable element 42 forcing process fluid 70 out of the inflation chamber 72 back into the main longitudinal passageway 30 of the open mandrel 22. The upper and lower fluid inflatable packers 150 and 154 may deflate to the initial deflated position or deflate to an intermediate deflated position that releases the seal against the wellbore 130 and allows the upper and lower fluid inflatable packers 150 and 154 to be retrieved from or repositioned in the wellbore 130.

[0060] Next, at decisional step 214, if another frac process is to be performed, the Yes branch of step 214 returns to step 200 in which the upper and lower fluid inflatable packers 150

and 154 along with the jetting tool 152 are repositioned in the wellbore 130 and the process repeated for another zone of the wellbore 130. If another frac process is not to be performed, the No branch of decisional step 214 leads to the end of the method in which upper and lower fluid inflatable packers 150 and 154 are inflated to seal the annulus 148 of the wellbore 130 during a frac or other process without being mechanically set such that the upper and lower fluid inflatable packers 150 and 154 are automatically released upon the termination of process fluid 70 pumping and the resulting reduction in process fluid 70 pressure. In addition, as previously described, unfiltered process fluid 70 may be used to directly inflate the upper and lower inflatable fluid packers 150 and 154 without the upper and lower fluid inflatable packers 150 and 154 becoming clogged, stuck, or permanently set.

**[0061]** Although the present invention has been described in several embodiments, various changes and modifications may be suggested to one skilled in the art. It is intended that the present invention encompass such changes and modifications as fall within the scope of the appended claims.

**[0062]** What is claimed is: